

ability, a method has been proposed where the circuit section and stimulating electrodes section are separate but are linked by a cable connected to each electrode (lower part of FIG. 18). This is exactly the situation of using earphones with a portable type audio player and enables an electrode portion held by hand to be extremely small and thin. However, in the case of using more electrodes than the few to a few tens of electrodes compatible with this method, there is the problem that the cable becomes thick.

Resolving Means

[0105] With regards to this, in a newly proposed method, a drive circuit is also mounted on the electrode side. Communication is then carried out between the drive circuit and a circuit box of a body. For example, electrodes providing stimulation are determined at a body side, and this instruction is sent to the drive circuit side. The drive circuit then deciphers the instruction signal and energizes the electrodes. The cable as a whole becomes thinner and easier to handle as a result of reducing the number of lines between the drive circuit and the circuit box of the body. Further, the thickness per each cable can be made thicker and the danger of damage to the cable is reduced. Moreover, in the method of the related art, an electrical stimulation pulse is sent through a long cable and corruption of the stimulation pulse waveform may therefore occur. In this method, the electrical stimulation pulse is generated by a circuit in the vicinity of the electrodes and it is therefore difficult for damage to the pulse waveform to occur. On the electrode side, it is also possible to mount a sensor system including force sensors and a camera, and the voltmeter and ammeter described in [B-4] on the electrode side. The sensors and the body can also be linked through communication. Further, the communication may also be wireless such as by using radio waves or infra red rays.

INDUSTRIAL APPLICABILITY

[0106] The present invention can be utilized in an electro-tactile display.

1. An electro-tactile display comprising:
 - at least one current source;
 - arrayed electrodes;
 - a switching circuit for connecting each electrode to the current source or to ground; and
 - electrode selecting/switching means for selecting an electrode connected to the current source and an electrode connected to ground via said switching circuit and switching over the selected electrodes;
 - said electrode selecting/switching means further comprising:
 - first electrode selecting/switching means for connecting one or a plurality of electrodes at a position or positions for stimulation to the current source to provide one or a plurality of current source electrodes and switching over said selected current source electrodes at a predetermined time interval to present tactile sensations; and
 - second electrode selecting/switching means for alternately connecting a plurality of neighboring electrodes in the vicinity of said current source electrodes to the current source and to ground at a time interval shorter than said predetermined time interval.
2. The display of claim 1, wherein said switching circuit is a half-bridge circuit.

3. An electro-tactile displaying method comprising:
 - selecting one or a plurality of electrodes from arrayed electrodes and connecting said selected electrodes to a current source to provide one or a plurality of current source electrodes;
 - alternately connecting a plurality of neighboring electrodes in the vicinity of said current source electrodes to the current source and to ground;
 - connecting a plurality of remaining electrodes other than said neighboring electrodes to ground to provide a plurality of ground electrodes;
 - providing electrical stimulation from said current source electrodes, said current source electrodes being spaced apart from said ground electrodes via said neighboring electrodes; and
 - switching over said selected current source electrodes at a predetermined time interval to present tactile sensations.
4. (canceled)
5. A method of providing electrical stimulation using arrayed electrodes comprising:
 - selecting one or a plurality of electrodes from the arrayed electrodes and connecting said selected electrodes to a current source to provide one or plurality of current source electrodes;
 - alternately connecting neighboring electrodes in the vicinity of said current source electrodes to the current source and to ground;
 - connecting a plurality of remaining electrodes other than said neighboring electrodes to ground to provide a plurality of ground electrodes; and
 - providing electrical stimulation from said current source electrodes wherein said current source electrodes are spaced apart from said ground electrodes via said neighboring electrodes.
6. The display of claim 1, wherein said display is used for a visual-tactile conversion system comprising said display and a camera.
7. The display of claim 1, wherein said display is a portable display.
8. The display of claim 1, wherein said current source is an anodic current source.
9. The display of claim 1, wherein said arrayed electrodes are provided on a curved finger mount and wherein each electrode comprises a round tip to contact a finger.
10. The display of claim 1, wherein said first electrode selecting/switching means switching over said selected current source electrodes at a predetermined time interval in accordance with stimulation pattern information from a computer to present tactile sensations.
11. The display of claim 1, wherein switching by said first electrode selecting/switching means is carried out at an interval of 500 ms to 10 ms and wherein switching of said second electrode selecting/switching means is carried out at an interval of 10 ms to 1 ms.
12. The method of claim 3, wherein switching of neighboring electrodes is carried out at higher speed than the switching of a current source electrode for providing tactile sensations.
13. The method of claim 12, wherein switching of the current source electrode is carried out at an interval of 500 ms to 10 ms and wherein switching of the neighboring electrodes is carried out at an interval of 10 ms to 1 ms. wherein

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